REMARKS

Claims 1-37 are currently pending in this application. Claims 7-18 and 25-37 have been withdrawn from consideration as a result of a restriction requirement.

Claims 1-6 and 19-24 stand rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 5,397,475 to Millar et al. in view of European Patent Application 0 245 940. Applicants respectfully traverse this rejection for the following reasons.

The present invention is directed to a process for producing purified aqueous hydrogen peroxide solution which includes a feed pump controlled in cooperation with a flow sensor. The flow sensor detects the flow rate of the hydrogen peroxide solution fed to a purifier tower packed with an ion exchange resin. The flow sensor is positioned between the feed pump and the purifier tower to ensure that the flow rate of the aqueous hydrogen peroxide solution charged into the purifier tower is maintained at a constant rate. The prior art of record does not in combination suggest the use of such a feedback loop to a pump for controlling the flow rate of charged hydrogen peroxide solution to a purifier tower at a constant rate.

As described at pages 3-6 of the present specification, purification of aqueous hydrogen peroxide solution in a purifier tower is typically plagued by bubbles formed by autolysis of hydrogen peroxide. The bubbles stick to the resin in the purifier tower and lower the purification efficiency of the tower. One solution for overcoming the problem of reduced efficiency has been to increase the solubility of the bubbles formed by autolysis of hydrogen peroxide by increasing the pressure in the purifier tower. However, during prolonged operation of a pressurized purifier tower, several problems develop. The area of contact between the ion exchange resin and the hydrogen peroxide solution is decreased. The band in the purifier tower where complete adsorption has occurred (adsorption of the impurity ions has been completed) or the band in the purifier tower where ion exchange is occurring becomes disordered. As such, the removal of impurities from the aqueous hydrogen peroxide solution is inefficient and results in increased pressurization and temperature rise within the ion exchange tower.

To overcome these problems, the present inventors discovered that controlling the output of the feed pump of the charged solution into the purifier tower to maintain the flow of hydrogen peroxide solution at a constant rate avoids accumulation of bubbles in the

purifier tower and suppresses sticking of bubbles to the ion exchange resin. In addition, the disordered nature of an adsorption band and ion exchange band is likewise suppressed. As such, the aqueous hydrogen peroxide solution easily passes through the purifier tower and the purification efficiency of the tower is high.

The prior art of record does not identify the problems solved by the present invention, nor the solution represented by the present invention as set forth in claims 1-6 and 19-24. The Millar patent discloses a process to purify aqueous hydrogen peroxide solution in which the solution is delivered from pump 5 through supply lines 9 and 10 to the top and bottom, respectively, of an ion exchange vessel 11. Nowhere in the Millar patent is there any discussion regarding the need to maintain a constant flow rate of the charged aqueous hydrogen peroxide solution flowing through either of the supply lines 9 and 10. The goal of the Millar patent is to shorten the residence time of the solution in the ion exchange vessel 11 and thereby minimize the risk for localized decomposition and explosion of hydrogen peroxide. According to the Millar patent, this is accomplished by delivering a portion of the solution to the bottom of the ion exchange vessel. A shortened residence time is achieved by slurrying the bed by delivering hydrogen peroxide (or other fluid) through the supply line 10. Nowhere in the patent is there any indication of the importance of controlling the flow rate of hydrogen peroxide delivered to the vessel 11. Hence, there can be no motivation to modify the process therein.

To account for the failure of the Millar patent to disclose a flow sensor for providing feedback to a pump on the flow rate of the charged aqueous hydrogen peroxide solution fed to the purifier tower, EP '940 is cited for its disclosure of control valves under computer or electronic control in an ion exchange separation system.

EP '940 discloses a system for automating the flow of a liquid to be separated in ion exchange columns and the flow of eluents for regenerating the columns. EP '940 notes that problems with conventional ion exchange systems include "uneven flow rates within the system and inappropriate eluents" and identifies a need to achieve ion exchange separation more reliably and automatically. According to EP '940, this is achieved by electronic or computer control of an arrangement of a solution inlet 13 with eluent or solvent inlets 14-17 through a series of ion exchange columns. The feed lines to the first ion exchange column 1 include a pump 7 and a three-way valve 24 for waste washing at line 24. There is no

feedback from the three-way valve or any other mechanism to the pump 7 for controlling the solution flow rate from the inlet 13 to the first ion exchange column or any of the subsequent columns. Pumps 8 and 9 are operated similarly with 3-way valves 5 and 6. The valves 4-6 and 10-12 are controlled by an electronic or computer control system in order to control the flow of the sample to be separated through line 13 and the elements in lines 14-17.

Despite the indication of EP '940 that uneven flow rates have been a problem, the reference indicates that this has required careful monitoring by operators, hence the need for automated control. There is no indication that the system described in EP '940 would achieve even flow rates of the material delivered to the ion exchange columns. All the system of EP '940 is designed to accomplish is to make the separations more reliable and automatic. The valves on the supply line 13 and eluent/solvent lines 14-17 are controlled automatically to avoid the use of a process operator. This is how the system of EP '940 can be operated "more reliably and automatically than conventional systems". Automation does not necessarily imply constant flow rates, as asserted in the Office Action. Moreover, nowhere in EP '940 is there any consideration given to a feedback loop for controlling the pumps 7-9. Only the valves 4-6 and 10-12 are indicated as being controlled for automation purposes. Although EP '940 identifies a problem with conventional ion exchange systems (uneven flow rates), there is nothing in EP '940 which would suggest providing a feedback control loop as in the present invention to achieve constant flow rates.

To the extent that the use of a flow sensor with feedback to a pump to control flow rates of a charged aqueous hydrogen peroxide solution is a technologically simple concept, neither of the cited references provides a motivation to use a flow sensor capable of sensing a flow rate of the charged solution to the purifier tower where the output of the feed pump is controlled in cooperation with the flow sensor to maintain the flow of charged solution at a constant rate. There is nothing in the Millar patent which would motivate one skilled in the art to be concerned about the flow rate of a hydrogen peroxide solution delivered to the vessel 11. In addition, while the control system disclosed in EP '940 may be beneficial for certain ion exchange separation systems, EP '940 does not implicitly suggest that feedback from a flow sensor to a pump would be desirable in the Millar process. As such, claims 1-6 and 19-24 define over the prior art of record.

Finally, claim 6 stands rejected under 35 U.S.C. §112, second paragraph, for indefiniteness. The Examiner asserts that method limitations are required in claim 6. Claim 6 is amended to overcome this rejection, and no change in the scope of claim 6 has been made by this amendment.

In view of the amendment to claim 6 and the foregoing remarks, claims 1-6 and 19-24 are believed to define over the prior art of record and be in condition for allowance. Upon indication of allowance of claim 6, a linking claim between the claims subject to the restriction requirement of June 26, 2003, claims 7-18 and 25-37 should also be allowed in the present application.

Respectfully submitted,

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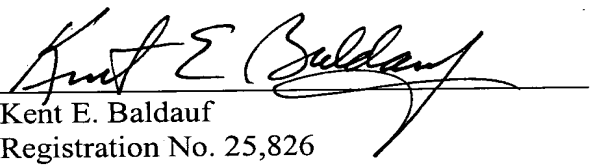
By 

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